XXXV.—Original Letters from James Gregorie, Professor of Mathematics in the University of St Andrews, to the Reverend Colin Campbell, Minister of Ardchattan, Argyleshire.

Communicated to the Society of Antiquaries by John Gregorson, of Ardfernish, Esq.

[Read, 10th January 1831.]

No. I.

St Andrews 1 Jan.

1679.

SIR,

I received your of the 23 of Deer last, and am glad to have the occasion to keep a correspondence with such a knowing person as ye ar. I have not had leasur at this time to satisfie you in your problem, being drawn away all this afternoon with necessarie affairs: but with the nixt I shall doe my endeavour; for I expect not to mak the calculation considerablie short, seing the nature of the question doeth not suffer it. Our bedal his book againest Mr Sinclare is come out several weeks ago (a). No more at present, but being in hast, & hoping that ye will be pleased to continue this new correspondence, I rest

Your humble servant,

J. GREORIE.

(Addressed)

Sir Colin Campbell,

Minister at Ardchattan.

(a) See Note A, page 282.
No. II.

St Andrews, 6 Janr.

1672 [1672-3]

SIR,

Be pleased to receive here enclosed an resolution to your probleme as short & applicable to trigonometric (a) as I can mak it. I thought it not necessar to follow out the operations, seeing it could doe you litle or no good, & wold require more of my time than I can spare at present. If ye doubt of anie thing in the solution, ye may advertise me with the nixt, & I shal strive to satisfie you. no more at present but desireing be all possible means to testifie my respects towards you,

I rest

Your humble servant,

(Addressed) for

J. GREGORIE.

Mr Coline Campbell,
Minister of Ardchatton.

[In the handwriting of Mr James Gregorie.]


[In the handwriting of Mr Colin Campbell.]

Mr Jacobus Gregorianus, Matheseos Professor Andreapoli, mihi roganti, hujus probl. hanc solutionem invent. 6 Jan. 1673.

TO THE REVEREND COLIN CAMPBELL.

No. III.

St Andrews, 11 febr.

1673.

SIR,

A considerable time ago I delivered an letter to mr Grant (who gave it to your brother) directed to you : in which I resolved your problem. your brother tells me that he sent yt letter to St Johnstoun ; if it can be had ther, ye may cause call for it, for I keepe no double : & I am so taken vp with other studies, that I have no leasur to doe the same thing over again. this solution of one particular case of this probleme q8 you sent to me in your last ye will find in Dr Wards (who is now bishop of Salis-
burie,) astronomica geometrica. no more at present but presenting my respects to you, I rest

Your humble Servant,

(Addressed) for Mr Colline Campbell,

(minister at Ardchatton. these.

No. IV.

St Andrews, 7. April.

1673.

Sir,

I being in Aberdein whil your letter was given here at my house, did not receive it til the 5 of this instant that I returned. I have also received your solutions of your probleme, which are to good purpose. I easily believe that you have not seen Wards Astr : geom : for I never yet heard of it in Scotland, that Problem, which ye propose, is the same with this. Datis tribus punctis non in directum jacentibus, invenire elipsin per data puncta transeuntem. this probleme is not determined, yea suppose ther wer 4 points ; and, therefore, it suffers innumerable solutions. When it is determined, it is this, and resolved by Ward in his Ast : geom : datis quinque punctis in ellipseos peripheria, ipsum ellipsoid invenire. that ye may easily see how this problem, as ye state it, is not determined,

sit triangulum ABC datum, per cujus angulos transire debeat ellipseos peripheria, dividatur latus quodlibet B C bifariam in D, et producatur A D ad libitum in E, dividaturque A E bifariam in F, sitque A D \( \times \) D E ; D C' : A F \( \times \) F E : F H' ; et G H parallela ipsi B C et bifariam divisa in F. evidens est ex ipsa constructione A E esse ellipseos quasitae diametrum transversam et G H ejusdem diametrum conjugatam : cunque A E posit capi ad libitum, modo

major quam A D, patet problema infinitas admittere solutiones. this is the most easie methode of resolving your problem, which giveth an infinite number of solutiones, albeit not all which can be given. the more general solution giving al possible answers is this following:

Sit triangulum datum A B C, eujus latus quodlibet A B dividatur bifariam in D : ducatur lateri A B parallela ex angulo opposito C P recta indepinta, dueaturque per punctum D recta F D, secans C P in E, ita ut tam recta F D quam angulus F D B sint ad libitum, sit primo D B : E C :: E C : E J et D B : E J :: D F : H F ; sitque E H : H F :: E D : E K, erit K F ellipseos quasi diametrum transversa, quae bifariam seetur in M ; sit deinde K D \( \times \) D F : DA' : : K M \( \times \) M F : M N', erit M N parallela recte A B ejusdem ellipseos semi-diameter conjugata, cum recta D F et angulus B D F arbitrarie sumantur; evidenter patet per hanc methodum dicti problematis infinitas infinitas dari solutiones. si angulus B D F ponatur rectus, inventae diametri semper erunt ellipseos axes, quos tantum pro ellipseos diametris videris assumere.

I adde not the demonstration of this construction, it being tedious, and not wereie hard to be discovered from the construction itself. this is all I am able to say to this, which can no wayes deserve these superlative applauses ye are pleased to honor me
with: however, if such speculations as these ar be pleasing to you, ye may command, according to the weakness of his capacitie,

Your humble servant
Jame Gregorie

(Addressed) for
Mr Colline Campbell,
Minister of the gospell
at Ardcchatton.

No. V.

Sir,

I am sorrie for my misfortun in loosing your companie whill ye wer here. It wer tedious to write down particularlie all the instruments I have brought home, yea a larger letter wold not contein all ther names & sizes, for I have of all sort: our largest quadrant is of oak, covered with brasse, 4 foot in radius and actually divided in minutes, of which we can judge ½ or ¼: wee have two semisextans, all of brasse, 6 foot in radius, diagonally divided, in which wee can judge ½ or ¼ of a minut. our largest telescope is 24 foot longe; which magnifiys one dimension of the object 100 times (a).

Your two first problems ar the same with the 27 prop: of the 8 book of Clavii geom: pract: which I beleiv yee have not seen. This problem yee propose concerning the ellipsis is prettie subtle, but is easie; if ye assume an circle in its place, and can be resolved by the 13 of the 4 of Euclide.

(a) The Commission granted by the Principal and Professors at St Andrews to Professor Gregory, in 1673, for purchasing these Instruments, is printed at the conclusion of these Letters, as Article XXVI.
the latitude here is $56^\circ : 22'$. the declination of the needle is $3^\circ 35'$ westward (a). No further at present but yt I am

Sir

Your most humble servant,

(Addressed) ff\for \ J. GREGORIE (b).

Mr Colline Campbell,

these.

Minister at Archatton.

(a) See Note C, next page. \hspace{2cm} (b) See Note D, next page.
NOTES ON THE PRECEDING LETTERS, BY PROFESSOR WALLACE.

Note A, page 275.
The Bedals Book was a satirical piece written by James Gregory, with this Title, "The Great and New Art of Weighing Vanity: Or, a Discovery of the Ignorance and Arrogance of the Great and New Artist, in his Pseudo-Philosophical Writings, by Patrick Mathers, Arch-bedal to the University of St Andrews. To which are annexed, Some Tentamina de Motu Penduli et Projectorum. Glasgow, printed by Robert Sanders, 1672," 18mo. pp. 101.

This work was intended to expose the supposed ignorance of a Glasgow Professor, George Sinclair, by no means a despicable person. He was the Author of a work entitled Ars Magna et Nova Gravitatis et Levitatis, in which he described the Diving Bell, which, however, had been invented before his time. He also wrote a Treatise on Hydrostatics, and other matters of science; and, strange to say! he was the author of 'Satan's Invisible World'—a book well known to the curious in Diablerie.

So deeply was Sinclair's mind infected with a belief in witchcraft, and the visible agency of evil spirits, that he introduced into the Miscellany Observations annexed to his Hydrostatics, the remarkable story of the Devil of Glenluce. A war of letters between the St Andrew's Masters and Sinclair began towards the end of the year 1671, and was carried on with acerbity on both sides. James Gregory would, of course, take the lead of the Masters. It is said that, besides the exposure of Sinclair's pretensions in philosophy, he had in view to chastise him for some alleged ill usage of one of his Colleagues. Sinclair, in a Postscript to his Hydrostatics, defended himself with the weapons commonly employed on such occasions in his time—a pedantic parade of learning.

Note B, page 276.
The enunciation of Colin Campbell's problem is not explicitly given in this letter. It may, however, be stated thus: Given the semiaxes A C, C D, of an ellipse, and a point G in the transverse axis, also the angle, which a line drawn from G to any point F in the curve, makes with the axis, to find the length of that line. The solution given by Gregory is general, wherever the point G may be in either axis; but it is probable that the ellipse was supposed to be the orbit of a planet, and that G was one of the foci; then, F being the position of a planet, the angle F G C is its true anomaly, if G be the focus in which the Sun is placed. Or if G be the upper focus, then, according to Ward's hypothesis, it is the mean anomaly.

In the case of G being a focus, a solution more simple may be given; for, putting the transverse axis C A=x, the eccentricity C G=e, the angle B G H=v, the line F G=r, it is shown by writers on astronomy, that

\[ r^2 = \frac{a^2 - e^2}{a - e \cos v} \]

Note C, page 282.
It may be worth while to state, that George Sinclair (mentioned in the note to the first letter) found, at or near Edinburgh, 7th November 1670, that the variation of the Magnetic Needle was three degrees and a half from the north towards the west. In the same year, Hevelius, at Dantzic, found it to be 7° 20'. Again, in the year 1734, MacLaurin found the variation to be between twelve and thirteen degrees westerly at Edinburgh; and, in the year 1823, it was found by the Writer of this Note to be 27° 1.'

Note D, page 282.
The publication of these Letters of James Gregory in the Transactions of a body whose object is to rescue from the ravages of time, and preserve from oblivion, every thing that can illustrate the early history of science and literature of Scotland, affords an opportunity to do him justice in regard to an important suggestion in astronomy, which is due to him, but which has commonly been ascribed to Dr Halley. That was the great advantage which astronomical science might derive from an observation of the transit of the planet Venus over the sun's disc; for this is perhaps the best of all methods by which the absolute distances of the planets from the sun, and, consequently, the magnitude of the solar system, can be determined. The importance of the observation of this rare phenomenon was indeed noticed by Kepler, who said that it would reveal to astronomers things which perhaps they would never know otherwise. It is not quite obvious, however, what Kepler here meant; but Gregory, in his Optica Promota, printed in 1663, proposed and resolved the problem, to investigate the parallaxes of two planets, from an observation of their apparent conjunction; and to his solution he adds this Scholium: *Hoc problema pulcherrimum habet usum, sed forsan laboriosum in observationibus Veneris vel Mercurii particulam solis obscurantis: ex talibus enim solis parallaxis investigari potest.* Here Gregory shows that he was fully aware of the advantage to be derived from this rare phenomenon. I mentioned this passage in the writings of Gregory to the late Dr Hutton; and he very properly noticed it in the Life of Gregory contained in the second edition of his Dictionary.
NOTES BY PROFESSOR WALLACE.

I beg leave also here to assert for Gregory the priority of discovery of a well known series for the arc of a circle. He was the first to shew that if \( t \) denote the tangent of an arc; that arc is equal to the very simple series, 
\[
\frac{t}{1} - \frac{t^3}{3!} + \frac{t^5}{5!} - \frac{t^7}{7!} + \cdots.
\]
He communicated this series to Collins, an eminent contemporary mathematician, in 1671, who sent it to Leibnitz in 1675, (see Commemoration Epistolicae, etc. pp. 98 and 130); and yet it appears that Leibnitz communicated the same series to his friends on the Continent at his own discovery, and even sent it to England in 1676. The English mathematician of that period charged him with appropriating Gregory's discovery to himself; but this, of course, he denied. The distinguished mathematician, Lagrange, has ascribed the series to Leibnitz, in his Calcul des Fonctions, p. 68. John Bernoulli, the friend of Leibnitz, however, while he asserted that Leibnitz had found it by his own powers, admitted that it had been previously found by Gregory.

Note E, page 285.

Although, from the following Commission given to James Gregory, empowering him to erect an observatory at St Andrews's, and procure philosophical and astronomical instruments, it might be supposed that his colleagues cordially supported his views for the introduction of the study of Natural Philosophy and Astronomy into the University; yet there is good reason to believe that the reverse of this was the fact. An eminent cultivator of physical and mathematical science, distinguished also for his intimate acquaintance with the history of its progress in Scotland (Professor Leslie) found, in the course of his researches, some letters written to and from Gregory, about the time he left St Andrews and came to Edinburgh. These he inserted in the Scots Magazine for 1810 (pages 584-6); and in a note introductory to them, he says, 'It appears from these letters that he encountered great opposition from the prejudices of his brother professors, who seem to have regarded the mathematics as exceedingly perilous to youth; and that he was on that account happy to accept a call to the Mathematical Chair in the University of Edinburgh, where his talents and pursuits were more favourably regarded.'

The correctness of this opinion seems fully established by a letter from Gregory to James Fraser, then residing at Paris: He says, 'Much honoured Sir, I received some days ago your very obliging letter; and not long after your arrival at Paris, I had another from you, to which, the truth is, I was ashamed to answer, the affairs of the Observatory of St Andrews were in such a bad condition; the reason of which was, the prejudice the Masters of the University did take at the mathematics, because some of their scholars, finding their courses and dictates opposed by what they had studied in the mathematics, did mock at their masters, and deride some of them publicly. After this, the servants of the College got orders not to wait on me or my Observations; my salary was also kept back from me; and scholars of most eminent rank were violently kept from me contrary to their own and their parents' wills; the Masters persuading them that their brains were not able to endure it. These and many other discouragements obliged me to accept of a call here to the College of Edinburgh, where my salary is here double and my encouragements much greater.'

XXVI.—Commission, University of St Andrews to Mr James Gregory, Professor of Mathematics, 10th June 1673. From the Original (a).

Communicated by John Gregory, Esq. Advocate.

[Read to the Society, 8th March 1820.]

Be it known to all men be these presents, Us, Rector, Principals, Doctors, and Professors of the University of St Andrews, under subscribing: For as much as we having formerly taken to our serious consideration the great detriment and loss this ancient seminary hath been at in times past, and doth yet sustain by the want of such proper and necessary instruments and utensils as may serve and conduce for the better, more solemn, and famous profession, teaching, and improving of natural philosophy and the Mathematical sciences, and especially for making such observations on the heavens and other bodies of this universe, (as easily may be by such helps, with the great advantage of the pure air and other accommodations of this place) whereby we may be enabled to keep correspondence with learned and inquisitive persons in solid philosophy every where, for the said effect: And having purposely (to be forthcoming to our own duty and the encouragement of others) to set as effectually as may be about this laudable and necessary work, for providing the requisite instruments and means, observatory and all other accommodations requisite for the improvement of the aforesaid sciences, the benefit, advantage, and delight of youth to be trained up here, the honour of the kingdom, the reputation of our benefactors, and the lustre and splendor of the University: Did therefore commission the number of our number to make application unto all persons whom they know to be the encouragement of learning, and patronize to the professors thereof, representing unto them, That we were instantly upon the effectuating of the same. Desiring, And to that end, to crave their affections and such other encouragements for the said work, as they please to bestow; And to report to us their diligence therein, with the names of our benefactors, To the effect this University may record them, and endeavour to make such respectful remembrances to them and their posterity, as becomes: Giving them power to do every other thing proper and requisite in the said affair. They being always answerable and accountable to us aent the premises. And whereas this our laudable designe hath already met with such considerable encouragement from persons of all ranks, that we have ordered Mr James Gregory, professor of the Mathematical sciences here, to

(a) See Note E, on the preceding page.